What Is Claimed Is:

1. An imaging method, comprising:

obtaining an image dataset of an organ;

processing the acquired image dataset to obtain feature data, wherein processing comprises:

obtaining image intensity feature data from the image dataset;

processing the image intensity feature data to obtain gradient feature data representing intensity change along each of a plurality of directions in a region of interest in the acquired image dataset; and

processing the gradient feature data to determine boundary layers between anatomical features of the imaged organ and surrounding objects or materials in the region of interest; and

rendering a multi-dimensional representation of the imaged organ using the obtained feature data.

2. The method of claim 1, wherein the image intensity feature data comprises intensity values for voxels of the image dataset, and wherein processing the image intensity feature data to obtain gradient feature data comprises determining a gradient feature value (GFV) for each voxel in the region of interest using a maximum directional gradient method.

3. The method of claim 2, wherein determining a GFV for a given voxel comprises:

determining an intensity gradient value for each of the plurality of directions based on intensity values of neighboring voxels of the given voxel along each of the directions;

determining a maximum absolute value of the intensity gradient values; and

setting the GFV of the given voxel as the maximum absolute intensity gradient value.

4. The method of claim 3, wherein determining an intensity gradient value for each of the plurality of directions comprises applying a scaling factor for unit lengths along the directions based on the voxel dimensions

5. The method of claim 2, wherein processing the gradient feature data to determine boundary layers comprises:

comparing the GFV of each voxel to a threshold GFV; and

labeling each voxel having a GFV that exceeds the threshold GFV as a boundary layer voxel.

6. The method of claim 5, further comprising applying a voxel classification method to cluster the voxels into a plurality of groups based on intensity values of the voxels.

7. The method of claim 6, further comprising using the classification results to determine if a given voxel is a boundary layer voxel when the GFV of the given voxel does not exceed the GFV threshold.

8. The method of claim 1, wherein rendering a multi-dimensional representation of the imaged organ comprises rendering a three-dimensional model of the organ that enables virtual endoscopic examination of the imaged organ.

9. The method of claim 1, wherein the organ comprises a colon and wherein the boundary layers include a lumen/colon wall boundary layer, a lumen/colonic residue boundary layer and a colonic residue/colon wall boundary layer.

10. The method of claim 1, wherein processing the acquired image dataset comprises segmenting the region of interest, wherein the region of interest comprises a cavity or lumen of the organ, tagged regions within the cavity or lumen, and a wall of the organ.

11. The method of claim 10, wherein processing the acquired image dataset further comprises:

detecting tagged regions; and

changing image intensity values of the detected tagged region to an intensity value of other tissue or material in the region of interest.

12. The method of claim 1, wherein processing the acquired image dataset further comprises reconstructing a first type of boundary layer into a second type of boundary layer.

13. The method of claim 1, wherein processing the acquired image dataset comprises automatically detecting organ abnormalities, if any, in the region of interest.

14. The method of claim 1, wherein rendering a multi-dimensional representation of the imaged organ using the obtained feature data comprises rendering a volumetric image using image intensity feature data of an original volumetric image dataset.

15. The method of claim 14, further comprising:

fusing additional feature data with the original volumetric image dataset to generated a fused volumetric image dataset; and

rendering a multi-dimensional representation of the fused volumetric image dataset.

16. The method of claim 1, wherein rendering is performed by volume rendering the image dataset.

17. The method of claim 16, wherein volume rendering comprises volume rendering an inner surface of the organ at a viewpoint from within a cavity or lumen of the organ.

18. The method of claim 17, wherein volume rendering the inner surface of the organ comprises adjusting a color map to display potential abnormalities on the inner surface with different color than normal regions of the inner surface of the organ.

19. The method of claim 1, wherein acquiring an image dataset comprises acquiring image data in a plurality of modalities and generating the image dataset by fusing image data of different modalities.

20. An imaging method, comprising:

obtaining an image dataset comprising image data of a colon that is prepared to tag regions of colonic residue in a manner that enhances a contrast between tagged regions of colonic residue in a lumen of the colon and a colon wall;

segmenting a region of interest in the image dataset, the region of interest comprising the colon lumen, the colon wall, and regions of tagged residue in the colon lumen;

electronically cleaning the tagged residue in the colon lumen using a gradient feature data obtained from the image dataset using a maximum directional gradient feature analysis; and

rendering a volumetric image comprising an endoluminal view at a region within the imaged colon.

21. The method of claim 20, wherein segmenting comprises detecting and removing regions of lung and bone in the image dataset by applying a low-level voxel classification process and using *a priori* knowledge of anatomy.

22. The method of claim 20, wherein segmenting is performed using a low-level voxel classification process and *a priori* knowledge of anatomy.

23. The method of claim 20, wherein the maximum directional gradient feature analysis comprises:

selecting several discrete directions in an image grid space of the image dataset;

for each voxel in the segmented region of interest, determining a first-order derivative along each selected direction from the voxel, determining a maximum absolute value of the determined directional first-order derivatives; and setting a GFV (gradient feature value) of the voxel as the determined maximum absolute value.

24. The method of claim 23, wherein electronically cleaning comprises:

extracting boundary layers in the region of interest using the determined GFV of the voxels in the region of interest, the boundary layers including a lumen/colon wall boundary layer, lumen/tagged residue boundary layer, and a tagged residue/colon wall boundary layer;

removing tagged residue regions; and

transforming a tagged residue/colon wall boundary layer into a lumen/colon wall boundary layer.

25. The method of claim 24, wherein extracting boundary layers comprises:

comparing the GFV of each voxel to a threshold GFV; and

labeling each voxel having a GFV that exceeds the threshold GFV as a boundary layer voxel.

26. The method of claim 25, further comprising applying a voxel classification method to cluster the voxels into a plurality of groups based on intensity values of the voxels.

27. The method of claim 26, further comprising using the classification results to determine if a given voxel is a boundary layer voxel when the GFV of the given voxel does not exceed the GFV threshold.

28. The method of claim 24, wherein removing tagged residue regions comprises transforming the intensity of voxels in the tagged region into a preset intensity.

29. The method of claim 28, wherein the preset intensity comprises an average intensity of air voxels in the volumetric image.

30. The method of claim 24, wherein transforming a tagged residue/colon wall boundary layer into a lumen/colon wall boundary layer is performed using a linear transformation process.

31. The method of claim 30, wherein the linear transformation process implements a voxel GFV as a penalty term.

32. The method of claim 23, wherein determining a first-order derivative along each selected direction from the voxel is performed using equations for different ranges to reduce the affects of noise.

33. The method of claim 23, wherein determining a first-order derivative along each selected direction from the voxel is performed using equations that include scaling factors based on dimensions of the voxels.

34. The method of claim 20, wherein rendering a volumetric image comprises volume rendering an inner surface of the colon wall.

35. The method of claim 34, wherein volume rendering comprises rendering the inner surface of the colon lumen with specific color map to display voxels of the colon wall in different colors based on intensity ranges.

36. The method of claim 20, further comprising automatically detecting potential polyps, if any, on the colon wall.

37. The method of claim 20, wherein rendering a volumetric image comprises fusing the polyp detection results into the electronically cleaned volumetric image.

38. The method of claim 20, wherein rendering a volumetric image comprises rendering an electronically cleaned volumetric image.

39. The method of claim 20, wherein acquiring an image dataset comprises acquiring image data using two or more imaging modalities and fusing the image data to form a volumetric image dataset.

40. A bowel preparation method for preparing a colon for imaging, comprising administering doses of contrast agents to an individual in combination with the individual following a low-residue diet regimen for a period of time prior to acquiring image data of the individual's colon.

41. The method of claim 40, wherein the contrast agents comprise a first contrast agent including a barium sulfate solution and a second contrast agent comprising a diatrizoate meglumine, and diatrizoate sodium solution.

42. The method of claim 41, wherein administering doses of contrast agents comprises administering 4 doses of the first contrast agent and 2 doses of the second contrast agent in about a 36 hour period prior to image acquisition and wherein following a low-residue diet regimen comprises following a fluid diet in about a 24 hour period prior to image acquisition and eating meals including food items from a suggested food list for about 2 days before the 24 hour period.

43. The method of claim 41, wherein administering doses of contrast agents comprises administering 4 doses of the first contrast agent and 2 doses of the second contrast agent in about a 36 hour period prior to image acquisition and wherein following a low-residue diet regimen comprises eating food from a meal kit in about a 24 hour period prior to image acquisition and eating meals including food items from a suggested food list for about 2 days before the 24 hour period.

44. The method of claim 41, wherein administering doses of contrast agents comprises administering 4 doses of the first contrast agent and 2 doses of the second contrast agent in about a 36 hour period prior to image acquisition and wherein following a low-residue diet regimen comprises eating meals including food items from a suggested food list for about 3 days before image acquisition.

45. The method of claim 41, wherein administering doses of contrast agents comprises administering 3 doses of the first contrast agent and 2 doses of the second contrast agent in about a 24 hour period prior to image acquisition and wherein following a low-residue diet regimen comprises following a fluid diet in about a 24 hour period prior to image acquisition.

46. The method of claim 41, wherein following a low-residue diet regime further comprises eating meals including food items from a suggested food list for about 1 day before the 24 hour period.

47. The method of claim 40, wherein the bowel preparation process is a laxative and suppository free bowel preparation process.

48. The method of claim 40, further comprising distending the colon prior to image acquisition.

49. The method of claim 48, wherein distending the colon comprises forcing air or carbon dioxide into the colon.

50. A program storage device readable by a machine, tangibly embodying a program of instructions executable by the machine to perform imaging method steps, the imaging method steps comprising:

obtaining an image dataset of an organ;

processing the acquired image dataset to obtain feature data, wherein processing comprises:

obtaining image intensity feature data from the image dataset;

processing the image intensity feature data to obtain gradient feature data representing intensity change along each of a plurality of directions in a region of interest in the acquired image dataset; and

processing the gradient feature data to determine boundary layers between anatomical features of the imaged organ and surrounding objects or materials in the region of interest; and

rendering a multi-dimensional representation of the imaged organ using the obtained feature data.

51. A program storage device readable by a machine, tangibly embodying a program of instructions executable by the machine to perform imaging method steps, the imaging method steps comprising:

obtaining an image dataset comprising image data of a colon that is prepared to tag regions of colonic residue in a manner that enhances a contrast between tagged regions of colonic residue in a lumen of the colon and a colon wall;

segmenting a region of interest in the image dataset, the region of interest comprising the colon lumen, the colon wall, and regions of tagged residue in the colon lumen;

electronically cleaning the tagged residue in the colon lumen using a gradient feature data obtained from the image dataset using a maximum directional gradient feature analysis; and

rendering a volumetric image comprising an endoluminal view at a region within the imaged colon.